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AN ANALYSIS OF INDIAN ROAD SPEED BREAKER FOR DESIGN IMPROVEMENT AND INCREASING THE LIFE AXLE OF AUTOMOTIVE VEHICLE BY FINITE ELEMENT METHOD

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ABSTRACT

The initial requirement for a project work is to identify and understand the nature of the problem. The problem is related to the Road and transport area. India is a one of the leading countries in Transport sector. Conserve energy and So as to conserve resources, weight loss has become manufacturing units' focus in the present situation. Weight loss can be achieved by the introduction of material with optimization. The Speed Breaker is one of the potential valued items for the production enlargement. As a result, the machine possesses more productive and efficient. Speed Breakers are crucial unit in Road & Transportation, essential to reduce the transverse vibrations, impacts and stresses due to temperature difference. When machine moves for mounting than some condition may appear like misalignment and loosing machine part. Unbalancing may occur due to this misalignment of tires and wheel. Environmental condition and poor maintenance are also affecting the speed breaker &tires wear & tear condition.

KEYWORDS: Speed Breaker, Wear & Tear

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Original Article

INTRODUCTION

Speed breakers on strategies to level had been constructed from security consideration. These could be apart from causing to road users convenience, harmful if not assembled.

Railway safety review committee believed the supply of as an encumbrance that is unnecessary strips as it impedes The stream of road traffic is exposed to traffic. They advocated that rumble strips assembled in manned's approaches Gates should be taken off.

A rate breaker is a hump surface through the roadway having shape with diameter greater than the vast majority of the vehicles using the wheel Foundation of the road. When is reduction variation in places where speed controls are needed and in stimulation, a speed breaker acts to arouse reaction. Since the driver response times are to tactile and audible stimulation than to stimulation, the speed is subconsciously reduced by a motorist. An ideally designed the following requirements should meet:

- There should be neither damage to vehicles nor excessive discomfort to the drivers and passengers when passing in the crossing speed.

- The hump should not give rise to cause or noise vibrations into the adjacent buildings or influence the area's residents.
- Above the plan speed, a driver should endure a growing amount of distress (but without losing directional control and without a car damage) determined by the extent where design speed is exceeded.

CAD MODELLING

Solid Works is a good modeling, computer-aided-design (CAD) and Computer-aided engineering (CAE) computer software for creating 3D digital prototypes used in the design, simulation and visualization of merchandise. Solid Works is 3D mechanical modeling design software developed by Massachusetts Institute of Technology to create 3D prototypes. It's used for product simulation, design communication, tooling production and 3D design. This program enables users to generate accurate 3D models to assist in simulating, visualizing and designing products before they're built.

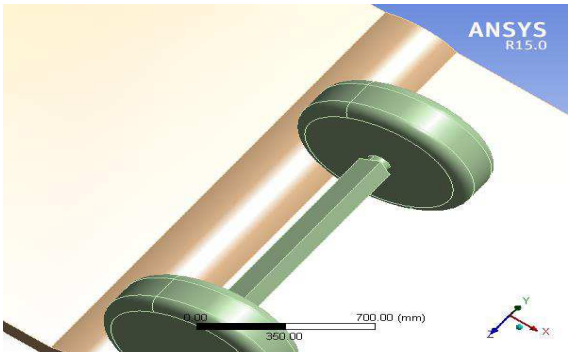

Figure 1: Rendering of the Assembly after Importing into ANSYS 15.0

Table 1: Geometry Specifications

Object Name	Tires	Speed Breaker
Length X	800. mm	5500. mm
Length Y	800. mm	150. mm
Length Z	1700. mm	2500. mm
Properties		
Volume	2.5631e+008 mm³	1.4046e+009 mm³
Mass	256.31 kg	1404.6 kg
Centroid X	1420.9 mm	1180.3 mm
Centroid Y	2996.5 mm	2547.8 mm
Centroid Z	5185. mm	4885. mm
Moment of Inertia Ip1	1.396e+008 kg·mm²	7.3263e+008 kg·mm²
Moment of Inertia Ip2	1.396e+008 kg·mm²	4.1977e+009 kg·mm²
Moment of Inertia Ip3	1.8815e+007 kg·mm²	3.4676e+009 kg·mm²
Statistics		
Nodes	1665	1404
Elements	7443	646

EXPLICIT DYNAMICS ANALYSIS

In ANSYS we have done the dynamic analysis on taking different cases as differentiate in terms of rotational velocity, tyre material and speed breaker material. There are total 18 cases which contains existing material as natural rubber, rubber 1 and rubber 2 which are pre-installed in ANSYS library for particular cases as in tyre

material and in case of speed breaker material we have taken as material like Runner 1, Rubber 2 and concrete. and last the cases are designed on rotational velocity 60 and 70 Rad/s. These all cases determine the mechanical properties as total deformation, elastic stress and elastic strain. The following cases are shown below in given table.

Table 2

Case No	Rotational Velocity	Tyre Material	Speed Breaker Material
1	60	Rubber-1	Rubber-1
2	60	Rubber-1	Rubber-2
3	60	Rubber-1	Concrete
4	60	Rubber-2	Rubber-1
5	60	Rubber-2	Rubber-2
6	60	Rubber-2	Concrete
7	60	Existing Material	Rubber-1
8	60	Existing Material	Rubber-2
9	60	Existing Material	Concrete
10	70	Rubber-1	Rubber-1
11	70	Rubber-1	Rubber-2
12	70	Rubber-1	Concrete
13	70	Rubber-2	Rubber-1
14	70	Rubber-2	Rubber-2
15	70	Rubber-2	Concrete
16	70	Existing Material	Rubber-1
17	70	Existing Material	Rubber-2
18	70	Existing Material	Concrete

RESULTS

The below graph shows the comparison between Existing material, rubber-1 and rubber-2 in context of Stress analysis, Strain analysis and Deformation at two different rotational velocity for the comparison as 60 rad/s and 70 rad/s.

Case 1: Maximum Deformation

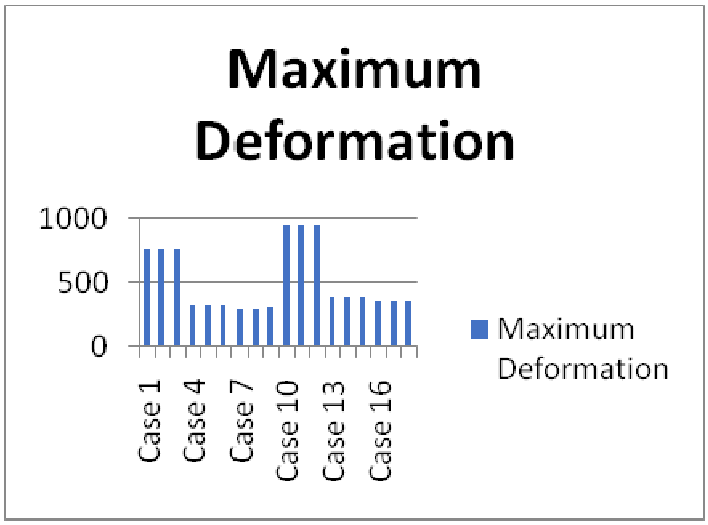

Figure 2

Table 3

Case 1	747.64
Case 2	747.64
case 3	749.42
Case 4	325.58
Case 5	325.58
Case 6	324.85
Case 7	301.98
Case 8	301.98
Case 9	302.72
Case 10	938.92
Case 11	938.92
Case 12	939.31
Case 13	385.74
Case 14	385.74
Case 15	385.72
Case 16	355.41
Case 17	355.41
Case 18	355.41

Case 2: Maximum Equivalent Stress

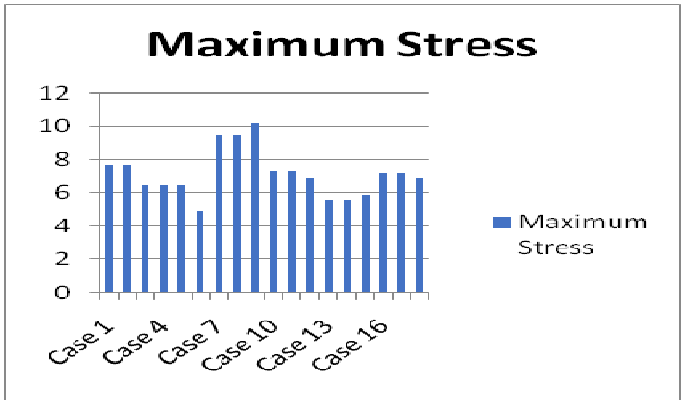

Figure 3

Table 4

Case 1	7.6844
case 2	7.6844
Case 3	6.4553
Case 4	6.4866
Case 5	6.4866
Case 6	4.8965
Case 7	9.5004
Case 8	9.5004
Case 9	10.232
Case 10	7.3439
Case 11	7.3439
Case 12	6.9104
Case 13	5.5851
Case 14	5.5857
Case 15	5.9084
Case 16	7.2424
Case 17	7.2424
Case 18	6.8977

Case 3: Equivalent Maximum Strain

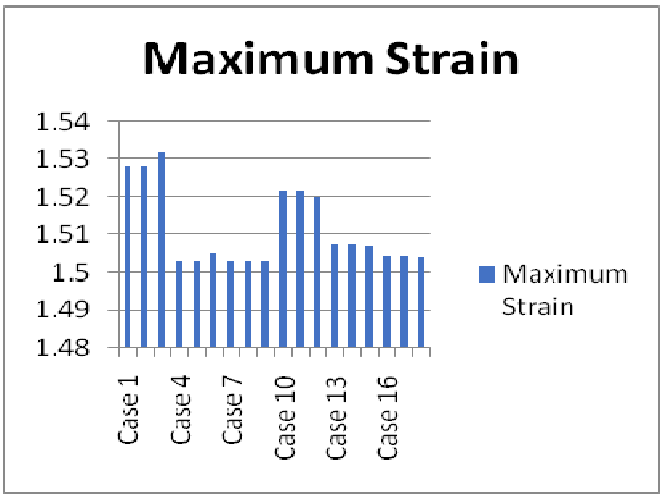

Figure 5

Table 5

Case 1	1.5285
Case 2	1.5285
Case 3	1.5321
Case 4	1.5033
Case 5	1.5033
Case 6	1.5051
Case 7	1.503
Case 8	1.503
Case 9	1.5033
Case 10	1.5219
Case 11	1.5219
Case 12	1.5199
Case 13	1.5076
Case 14	1.5076
Case 15	1.5073
Case 16	1.5046
Case 17	1.5046
Case 18	1.5043

CONCLUSIONS

Structural Analysis shows that minimum deformation occurs in assembly, when the tire is made by existing material & speed breaker is made of proposed material irrespective to the speed.

FUTURE SCOPE

The Road Transport System has a lot of opportunities for updation. In this project work a part of Road Transport System i.e. Speed Breakers are updated.

The best materials are proposed in this project work. More materials can be optimized with the help of this project work.

- On the basis of literature survey more effective parameters can be used in further project.

- The safety factor and fatigue analysis will be used for life cycle analysis.
- This work will be helpful for the researchers, who are working in Transport analysis area.

REFERENCES

1. *Mohit Jain, Ajeet Pal Singh "Speed Breaker Early warning system", in "USENIX conference "2012. https://www.iiitd.edu.in/~skkaul/Papers/nsdr12-final11.pdf.*
2. *Shan Liang, Q Zhu."The influence of parameter of consecutive speed control humps on the chaotic vibration of a 2-DOF non linear vehicle model. in Journal of Vibro Engineering, september 2011.*
3. *Galal Ali Hasan "Car Dynamics using Quarter Model and Passive Suspension.-Effect of Suspension Damping and car speed" In International Journal of Computer Technique, January 2014.*
4. *Galal Ali Hasan "Car Dynamics using Quarter Model and Passive Suspension.-A Novel Polynomial Hump" In International Journal of Mechanical and Civil Engineering", January 2015.*
5. *Sancheti, G., Nagar, R., & Agrawal, V. (2014). Prediction of Deflection in Post-Tensioned Slabs at Conceptual Stage of Design by Applying Resubstitution Validation Technique.*
6. *Galal Ali Hasan "Car Dynamics using Quarter Model and Passive Suspension.-A Novel Simple Harmonic Hump" In International Journal of Mechanical and Civil Engineering", Feb 2015.*
7. *Gupta, I., & Saxena, G. (2014). Structural Analysis of Rotor Disc of Disc Brake of BAJA SAE 2013 Car through Finite Element Analysis. International Journal of Automobile Engineering Research and Development (IJAuERD) Vol, 4, 1–10.*
8. *Abaid Ullah, Salman Hussain, Ahmad Wasim, Mirza Jahanzaib "Usage and Impact of speed humps on vehicle in " Journal of Advanced Review on Scientific Research 28, Issue. 1 (2016)*
9. *Royanian, S., & Nozary, M. Elements of Hope and Life in the Poetry of Farrokhzad and Plath.*
10. *Sabry Allam, Fathey Nader, M. Rabea, "Effects of speed breaks on vehicle dynamics and ride comfort" in International Journal of Engineering Inventions e-ISSN: 2278-7461, p-ISSN: 2319–6491 Volume 6, Issue 10 [October. 2017] PP: 01–09*
11. *Zaghloul, M. S. (2014). Design of Open Architecture Electronic Chart Display and Information System (ECDIS). International Journal of Research in Engineering & Technology, 2(1).*
12. *Mitul Patel, Prof.(Dr.) P. J. Gundaliya "A study on Speed Breakers"in International Journal of Advance Engineering and Research Development Volume 4, Issue 3, March -2017*
13. *KSB Prasad, S. Naveen Kumar, D. S. Aravind Varma "A Review on Present Trend in Speed Bump" in International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277–3878, Volume-7 Issue-4, November 2018.*